Saltwell Portable Exhauster

The Challenge

Hanford has 149 single-shell waste tanks (SSTs) that contain high level radioactive waste. Some of these tanks contain free liquids which are being transferred to safer double-shell tanks in a process called "saltwell pumping." A number of these SSTs have been identified as having the potential for producing flammable gases. The gases are generated primarily by radiolysis of water contained in the waste and then released into the tank dome space during steady state and episodic events. Release of flammable gas, if not diluted, could create the potential for flammable/explosive concentrations within the tank.

Side view of a portable exhauster located in a tank farm. Temporary scaffolding is erected around the vent stack.

To reduce the risk, exhausters are required to remove the gases by drawing air into the tank and sweeping out flammable gas. Since the potential concentrations of the flammable gas could be well above the 25% Lower Flammability Limit safety limit, the exhauster equipment in contact with the "wetted" air stream must be qualified to operate in a flammable gas environment. This includes meeting the Tank Waste Remediation System (TWRS) Authorization Basis Ignition Set Controls, as well as the National Fire Protection Association (NFPA) hazard classifications.

Current Approach

SSTs are ventilated either by permanently installed active ventilation or by passive ventilation through HEPA filtered tank openings. The permanently installed existing tank ventilation systems provide tank headspace air changes that remove flammable gas and maintain particulate confinement. However, the aging active SST ventilation systems require high maintenance and do not have features to ensure the HEPA filters are operating as required. Since these systems are ventilating more than one tank at a time, they are not required to meet the flammable gas controls identified in the TWRS Authorization Basis.

Benefits and Features

- Flammable gas qualified with safety interlocks
- Skid-mounted and portable
- Suitable for multiple tank farm locations
- Programmable logic controller

Passive systems consist of a HEPA filter and HEPA filter housing located on the top of a riser attached to the tank. Ventilation is provided by the changes in temperature and atmospheric pressure causing the tank to "breathe" naturally. The flow rate associated with passive ventilation is very low and is not adequate to support saltwell pumping.

New Technology

A portable exhauster is now being used to support safe operations during saltwell pumping. It was designed and constructed to meet the most stringent flammable gas controls as prescribed by the NFPA criteria for Class 1 Division 1 Group B. The Continuous Air Monitor (CAM) located in the stack of the exhauster meets the applicable Ignition Set Controls.

The entire system was designed with flexibility that allows it to operate in different field conditions and tank farm locations, including a wide variation of flow rates and varying physical placement in the field. Tank farms have a variety of sloped and flat terrain and are cluttered with aboveground equipment and facilities that support operation of the underground tanks. The skid-mounted exhauster system includes self-leveling jacks and a programmable logic controller (PLC) for total system control and data communication to the remote operator control room. Exhauster instrumentation is centrally located to facilitate efficient data gathering. A shrouded probe instrument on the ventilation stack is an innovative technology that extends the range of stack flow rates that can be sampled, and meets the new ANSI standard for stack sampling. The HEPA filter housing is designed to allow independent testing of each filter as required by ASME N510 criteria.

Communication links between the portable exhausters and the saltwell pumping equipment ensures alarms, shutdowns, and safety pump interlocks are promptly recognized in the operations control room. Tank pumping is terminated prior to ventilating to protect against a spray leak accident in the transfer piping system. Such a leak could be carried into the exhauster by airflow, saturating the HEPA filters and possibly resulting in nearby or off-site contamination.

The portable exhauster provides an intrinsically safe flammable gas qualified system for all tank farm applications, positive flow evacuation rates with measurable flow quantities, approved HEPA filtration and important instrumented control data for accurate and reliable operations.

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